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Fission Detection Using the Associated Particle Technique

Authors: R.P. Keegan, J.P. Hurley, J.R. Tinsley, R. Trainham, S.C. Wilde

Abstract

A beam of tagged 14 MeV neutrons from the deuterium-tritium (DT) reaction is used to induce fission in a target composed of depleted uranium. The generator yield is 10^7 neutrons/second radiated into a 4π solid angle. Two 4 in.×4 in. NaI detectors are used for gamma-ray detection. The fission process is known to produce multiple gamma-rays and neutrons. Triple coincidences (α-γ-γ) are measured as a function of neutron flight time up to 90 ns after fission, where the α-particle arises from the DT reaction. A sudden increase in the triple coincidence rate at the location of the material is used to localize and detect fission in the interrogated target. Comparisons are made with experiment runs where lead, tungsten, and iron were used as target materials. The triple coincidence response profile from depleted uranium is noted to be different to those observed from the other target materials. The response from interrogation targets composed of fissile material is anticipated to be even more unique than that observed from depleted uranium.

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